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Working Paper on diversion of commercial chemicals for weapons

As many delegations, including our own, have noted, there are three major categories of substances related to chemical warfare:

(1) Single-purpose agents. These agents have no large-scale use for prophylactic, protective or other peaceful purposes. This category includes the super-toxic organophosphorus nerve agents, as well as some less toxic agents which have no important peaceful applications.

(2) Dual-purpose agents. Chemicals in this category have important civilian applications, but might also be used as CW agents. Many of the CW agents used in World War I are in this group, including phosgene (carbonyl chloride), chlorine and hydrogen cyanide.

(3) Precursors. Chemical compounds used as intermediates in the production of super-toxic agents may or may not have civilian application. For example, phosphorus trichloride, a key precursor in the production of organophosphorus nerve agents, is widely used as an intermediate in the manufacture of pesticides and plasticisers. On the other hand, another important precursor, methylphosphonic dichloride, is not currently used in producing commercial organophosphorus chemicals (but could be in the future).

This suggests that verification of a ban on production of CW agents has two major aspects: (a) ensuring that single-purpose CW agents and single-purpose precursors are not being produced and (b) making certain that dual-purpose agents and dual-purpose precursors are not being diverted to non-peaceful purposes.

Several delegations have suggested that statistical monitoring of chemical production could play an important role in deterring diversion of dual-purpose chemicals to prohibited military uses. Under this approach, data on the production and consumption of raw materials and intermediates would be analysed to ensure that no diversion occurred. The United States delegation presented some preliminary conclusions

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and comments on this approach in a previous working paper (CCD/311, 25 August, 1970). At that time we noted that there were certain problems and disadvantages to be overcome, particularly in regard to identifying deliberate attempts at deception.

The United States has continued its research on economic data monitoring in an effort to overcome some of the shortcomings identified in CCD/311. This paper is based on a study sponsored by the US Arms Control and Disarmament Agency, entitled "The Role of Phosphorus Control in Verification of a Ban on Nerve Agent Production: An Economic and Technical Analysis", carried out by Midwest Research Institute (Kansas City, Missouri).

Control System for Phosphorus

Among the potential CW agents, super-toxic organophosphorus compounds are generally considered to pose the greatest danger. The structure of these agents and possible processes for producing them may vary widely; however, phosphorus is the one substance which is a key input for manufacture of any organophosphorus agent. This suggests that production of such agents might be prevented by establishing controls over elemental phosphorus and any phosphorus compounds which could serve as precursors ("divertible" phosphorus compounds). Controls would not cover "non-divertible" compounds.

A control system might be established to monitor the production, storage, transportation and use of all phosphorus compounds which can be used in the production of a nerve agent. The objective would be to ensure that all consumption of divertible phosphorus compounds could be traced to legitimate activities. To accomplish this task, the industrial enterprises which handle these materials would be required to maintain detailed internal records and to prepare periodic reports on all relevant activities. In addition, all transfers between plants of this kind would have to be documented by records prepared by the shipper, the carrier and the consignee. To ensure the accuracy of these industry-level reports, several types of checks would be incorporated into the system.

The administration and operation of the control system could be divided among several levels -- industry, national control agencies and an international control agency. Industrial enterprises would be required to follow authorized material handling procedures, maintain adequate accounting records and report to the national control agency. The national body would have primary responsibility for applying the controls to enterprises which are within the territory of the state involved, or are under its jurisdiction or under its control anywhere. Verification that all industrial establishments have complied with all provisions of the control system would be provided

by the national body to the international control agency. The international agency would oversee the entire system, analyse and audit reports from each national agency and monitor the international trade of controlled materials.

Verification

In order to provide a reasonable degree of assurance that no diversion is occurring, such a control system would need to be designed so that the accuracy of reports from industrial establishments and from the national control agencies could be verified. There appear to be three basic verification techniques which could be used by the control agencies to determine the accuracy of reports: (1) analysis of statistical information presented in the reports, (2) examination and analysis of records, and (3) technical inspection. In this paper the discussion will focus on the verification activities of the international control agency.

The first step taken by the international control agency to verify the system's reporting accuracy would be analysis of the reports submitted by the national control agencies and perhaps by certain industrial enterprises. This would include review of the statistical data to ensure that all quantities balanced and that they were in line with those expected.

Periodically the international control agency would audit relevant records of national control agencies. In addition they would have the authority to conduct audits of national control agencies and individual industrial enterprises at any time to resolve discrepancies. While the procedures which would be followed are very similar to those employed in conducting a financial audit, they would, of course, be concerned with quantities of phosphorus and their disposition.

It would be necessary to develop a reliable system based on technical inspection for detecting false records. The types of technical inspection which could be employed are: (1) visits to certain chemical plants, (2) technical analysis of plant operating data, (3) analysis of samples of phosphorus-containing chemicals which are in inter-plant transit, and (4) monitoring of metering devices which provide independent information on plant production rates.

Evasion.

There are two principal ways in which evasion could occur. Either the phosphorus material would be diverted from within the system or it would be obtained from sources outside the system's control. For evasion techniques which operate within the system, records and reports at the industry and national level would be changed to avoid detection from discrepancies, or imbalances, in the reports. By definition, evasions outside the system have no effect on the records and would have to be detected by other means.

Possible Methods of Evasion Within The Control System

The possible means of evasion within the control system which have been identified in our studies are summarized below:

1. An elemental phosphorus plant understates the production of phosphorus and diverts the excess to an agent plant.

2. A multi-product plant reports an incorrect production mix between divertible and non-divertible phosphorus compounds.

3. A plant overstates the production of a non-divertible item and diverts an equivalent amount of input material.

4. The amount of phosphorus in a product is overstated by a plant.

5. An establishment reports high loss rates of divertible material or low efficiencies in production processes which use divertible materials.

6. A plant uses wet process phosphoric acid (not produced from elemental phosphorus) to produce material and reports the production as using "furnace acid" (phosphoric acid produced from elemental phosphorus).

7. A country diverts small amounts of phosphorus from a large number of plants.

8. A plant fails to register its phosphorus recovery process.

9. A nerve agent plant registers as a legitimate industrial phosphorus user.

A detailed examination of the United States phosphorus industry has revealed the following concerning potential evasions within the control system:

1. The greatest potential for obtaining phosphorus for CW agent production appears to be diversion of elemental phosphorus. Diversion from the phosphorus production plant would require less record modification and would be more difficult to detect than other diversion methods.

2. Exports of elemental phosphorus and production of white phosphorus munitions, the only major end uses of phosphorus in the elemental (white) form, are also potentially major points for diversion.

3. Recovering significant quantities of phosphorus for agent production by reprocessing chemical end products appears to be the least feasible of the evasion procedures considered.

Evasions Outside of the Control System

Evasion might occur outside the control system in several ways:

1. An elemental phosphorus plant does not register with the control agency.

2. Nerve agent precursors are produced directly from phosphate rock, rather than from elemental phosphorus.

3. Phosphorus material for agent is recovered from an end use product.

4. Phosphorus material is imported from a country which is outside of the control system.

5. Phosphorus or phosphorus-containing precursors are stockpiled prior to agreement.

6. Demilitarization of obsolete chemical munitions or agents which are not entered into the system.

Preliminary Evaluation of Effectiveness

The verification technique discussed in this paper differs significantly from the economic data monitoring technique discussed previously (CCD/311) in that provisions for technical inspection have been incorporated. In the new approach, statistical data provide the background for combined use of audit and technical inspection procedures. This technique increases the utility of economic data monitoring since the audit and technical inspection procedures complement one another.

While conventional on-site inspections would be useful in some circumstances, they would not be highly effective in detecting some very important kinds of evasion within the system. For example, diversion of phosphorus from an elemental phosphorus plant is unlikely to be detected by observation of plant activities. At the time of the inspection the plant authorities most probably would not try to divert any phosphorus.

However, an unconventional kind of technical inspection might be effective in detecting certain kinds of diversion, including that illustrated in the previous example. This technique would combine a technical analysis of plant operating records with conventional records auditing procedures. The technical analysis would consist of a correlation of reported production figures with such data as (a) consumption of starting materials, (b) production of by-products, and (c) electrical power consumption. This type of audit would not necessarily be performed on-site; however, access to complete plant records would be required.

Two other kinds of technical inspection could also be very useful: (a) the analysis of samples obtained from inter-plant shipments, and (b) the metering of the production of elemental phosphorus and phosphoric acid. These techniques might help detect certain kinds of diversion that could not be detected any other way. For example, production metering would be the best way to prevent an attempt to divert phosphorus at an elemental phosphorus plant by misstating actual production. Chemical analysis of samples of phosphoric acid would help forestall efforts to substitute "wet process" acid (produced from phosphate rock) for "furnace" acid

(produced from elemental phosphorus) and then divert the unused phosphorus to agent production. "Wet process" acid contains relatively large amounts of impurities, which are not present in "furnace" acid.

For the control system to provide any deterrent to the diversion of phosphorus to nerve agent production, three specific measures should be provided in the operation of the system. First, the international control agency should have access to reports from individual enterprises. This is important because the statistical analysis of the reports submitted by an individual plant is one of the principal methods of detecting the diversion of phosphorus material. National reports would not contain sufficient detail to enable the international agency to detect statistically the material diverted by several of the possible evasion methods.

Second, the international control agency should be allowed to conduct an investigation of a plant's records. Unless an independent investigation is possible, evasion of the system would not be difficult. The risk of detection by an investigation could substantially increase the deterrent effectiveness of the system.

Third, technical inspection should be an integral part of the data validation procedure. A standard records audit would not be sufficient to verify the accuracy of the records.

A phosphorus control system, with the verification provisions discussed in this paper, could probably ensure that large quantities of phosphorus-containing chemicals were not being diverted from commercial channels to weapons purposes. In itself this capability would not be sufficient to provide adequate assurance of compliance. Diversion of some significant quantities could still be accomplished by a determined evader. In all likelihood, however, phosphorus would not be diverted from commercial channels but rather obtained from sources not subject to the control system.

Phosphorus monitoring could play a useful role in verifying compliance with a production ban, although further verification measures would also be needed.